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ABSTRACT

Prompted by the realization that a reference text presents special problems in audience address since there is typically a diverse set of users, a study was designed to provide preliminary data on the use of the reference text, "The Making, Shaping and Treating of Steel," a landmark book in the steel industry. Data on the use of the text were collected through interviews, requiring approximately one hour, with a sample of 19 users of the text from various segments of the industry. Questions were divided into four categories: (1) background questions involving relevant characteristics of the respondents, edition of the book used, and number of years used; (2) questions of last usage; (3) questions of general use; and (4) problems and suggestions for improvement. Results indicated that the text was considered by most users as the reference of first resort to which they turned for information, and its scope was viewed as comprehensive. However, respondents did complain that the book did not provide them with follow-up resources--more detailed or alternative presentations. On a scale of 1 to 5 (1=very good, very useful; 5=throw it out of the window), the readers rated the book at an average of 1.8, which indicates there are ways to improve the text. In fact, respondents offered 13 recommendations for improvement. (HOD)

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Audience Analysis for *The Making, Shaping and Treating of Steel:* A Pilot Study

Mark J. Stein, Thomas M. Duffy, Kenneth Dye

October 1984

CDC Technical Report Series

Communications Design Center

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The Making, Shaping and Treating of Steel :

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Final Report presented to

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and

The Association of Iron and Steel Engineers

Mark J. Stein, Thomas M. Duffy, Kenneth Dye

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Table of Contents

Executive Summary 1

Purpose of the Study 1
Design of the Study 2
Conclusions and Recommendations 2
Final Remarks 6

"The Making, Shaping and Treating of Steel" 7

Introduction 7
Purpose of the Study 7
Background 8
Method 12
Respondents 12
Questionnaire 13
Results 15
Who uses Which edition When 15
What sort of information are people looking for? 16
Requirements for General Information 18
Requirements for Specific Information 21
MSTS as an Educational Tool 25
The Structure of the Book 27
Design Format 28
Access: How Readers Find Information 29
Conclusions and Recommendations 33
Marketing 33
Audience Analysis 35
Design for Future Editions 37
Information Displays 37
Information Access 38
Final Remarks 40

Questionnaire 41

Executive Summary

PURPOSE OF THE STUDY

The research reported here was designed to provide preliminary data on the use of the reference text, the *Making Shaping and Treating of Steel* [MSTS]. The data is meant to better define the audience for the book and the way in which that audience uses the book. The audience is a basic component in the communication triad. There is not just a writer and a text, there is also an audience receiving the information in that text. Indeed, a text will only be used to the extent that the author meets the needs of the audience.

A reference text presents special problems in audience address since there is typically a diverse set of users; diverse in terms of the knowledge base they bring to the text as well as in terms of the types of information they require. While it is recognized that MSTS is widely used in the steel industry, no data is available on the diversity of its users or on the diversity of ways in which the text is used. No data is available to provide guidance on the breadth or depth of information required, or the layout, style, and information access systems that would promote optimal ease of use.

The objectives of this study were to establish a methodology for assessing audience requirements and to provide preliminary data, using that methodology, on those requirements. The findings are seen as having three uses:

1. The data, and the methodology employed, can be used to design a more intensive data collection effort e.g., what subgroup[s] to focus on and what aspects of the use of the book should be explored in depth.

2. The findings may be used as input for the redesign of any future editions of MSTS to make it a more usable reference text.

3. The data will provide a data base for improved marketing of the book, identifying not only who the audience is but why and when they obtained their current copy of the book and what they see as the strengths of the book.

DESIGN OF THE STUDY

Data on the use of MSTS was collected through interviews, requiring approximately one hour, with a sample of users of the text. The interviews took place at the interviewees workplace and the questioning was guided by a structured, open-ended questionnaire.

The questions were divided into four categories: (1) Background questions involving relevant characteristics of the respondents, edition of the book used, number of years used, etc.; (2)questions of last usage; (3) questions of general use; and (4) problems and suggestions for improvement. The questions on usage and on improvements revolved around the four dimensions of usability: depth of coverage, breadth of coverage, information access, and comprehensibility.

Because of the lack of data on the primary markets for MSTS, it was determined that this pilot testing should represent a broad range of users. A taxonomy involving two dimensions--industrial segment of the steel industry and job classifications within the segments--was developed to guide the sampling. The final sample of companies included two large suppliers, and integrated producer, a specialty producer, a small supplier, and a university. A total of 19 individuals were interviewed across the companies: 3 were involved in research and development; 2 were steel engineers; 6 were civil, electrical, and mechanical engineers not exclusively involved in steel; 3 were operators; 2 were academics, and 3 were salespeople.

CONCLUSIONS AND RECOMMENDATIONS

Marketing

MSTS (in one edition or another) is widely used and is viewed very favorably. It is indeed considered the "reference of first resort," thus indicating the positive value of the comprehensive nature of the book. It is also rated very highly in terms of "usefulness." Our results, however, indicate that the usefulness is not based on the currency of the information; often the book is productively used, despite the fact that information is out of date.

An issue in coming editions will likely be the cost of MSTS. Many of our respondents reported receiving or purchasing the book in school, but if the book is to be priced at a fair market value it will be out of reach for many students-to-be-engineers.

> **Recommendation 1**: Future editions of MSTS should involve a very detailed user analysis to insure that user requirements are being met. This will be required to overcome the effects of the increased cost and of the lack of a felt need to own a current edition.
> **Recommendation 2**: Lower cost alternatives to the unabridged edition of MSTS should be considered. The unabridged edition would be designed to represent a prestigious as well as useful volume. However, sections of the book (e.g., making, shaping, treating, and historical perspective) might be offered in lower quality paper and coverings. This is especially important in tapping the academic market, the place where many people reported first using MSTS.
> **Recommendation 3**: Marketing the (tenth edition) must not only focus on getting the word out but also must tell the potential buyers what is new in the the tenth edition. This cannot be presented in gross generalities, e.g., "up to date review of production procedures." Rather, specific information, including examples, must be presented.

Designing MSTS

Despite the fact that research engineers are the primary writers, or information resources for writers, of MSTS, they use MSTS in very different ways from the majority of the audience. While the researchers are looking for general descriptive information outside of their area of specialization, the production people are looking for more detailed information within their area of specialization. These differences indicate that if we are to maximize the market attraction of MSTS and the usability of MSTS, the research engineer/writer must not be the ultimate judge of the contents or design of MSTS. Rather, that input must come from the dominant user groups.

> **Recommendation 4**: A procedure and methodology must be established to insure that writers and engineers understand the needs of the primary audience and that drafts of the chapters are evaluated by that audience. Planning information could be obtained through a survey in *Iron and Steel Engineer*. Research at the *Communications Design Center* has provided clear evidence for the importance of user testing documents. While we conducted user testing with the selected chapters of the tenth edition, the audience tested was research engineers. While such testing is necessary for assessing accuracy, it is imperative that the drafts be tested for completeness, access, and comprehensibility using individuals from the more dominant user groups.

The primary use of MSTS is directed at obtaining specific information. Even in those instances where the use is described as seeking "general" information, the reader typically only makes use of the information on a single page. There is seldom any jumping around between chapters or even within chapters.

The information actually obtained comes from text about half the time and from graphic displays of various sorts the rest of the time. All of the displays are rated quite highly and the readers do not suggest any changes in the use of the various display types (text, graphs, tables, etc.). None of the display types were considered difficult to use or understand.

These reader reports are not entirely consistent with research findings. The respondents report that information is obtained from text at least half of the time and that text is an adequate display type. However, research findings indicate that graphic displays are far more effective for obtaining specific information--especially when that information is within the reader's area of specialty. It could prove beneficial in planning the design of future editions to evaluate the usability of various information displays for the same basic information.

> **Recommendation 5**: Preliminary testing of the acceptability and the usability of various information displays for the same basic information could contribute significantly to the overall usability of the book and guide decisions on the design of the chapters.

There were three specific findings regarding the comprehensibility of information displays.

> **Recommendation 6**: Include a size reference in all photographic displays to provide the reader with a sense of perspective.
>
> **Recommendation 7**: Include the reasons for historical developments and clearly designate historical events as such. Specific years should be indicated rather than simply saying "In the past" or "currently." Furthermore, the problem or opportunity that led to a change in the process or procedure should be indicated.
>
> **Recommendation 8**: Review page layouts to insure that graphic presentations always occur on the same or opposing page as the first text reference to the graphic. Our assessment of several chapters in the ninth edition indicated that graphics and text are coordinated far less than is possible.

While there was little problem reported with the comprehensibility of the

display types, there was clear and frequent commentary on the amount of information presented and the ease of finding that information. The readers in general are looking for very targeted information, which means that the text must aid in that search effort. While the respondents indicate that they use the index (and that the index is effective), we observed them consistently using the very inefficient process of leafing through the pages.

Our findings led to several very specific recommendations for increasing ease of accessing information.

> **Recommendation 9**: Provide a table of contents at the beginning of each chapter which presents the structure of the chapter (primary and sub-headings) and page numbers. Usually the reader can determine the correct chapter, or at least narrow the source down to a couple of chapters. However, once to the chapter, the reader leafs through trying to use graphic displays as a key to the content on the particular pages.
>
> **Recommendation 10**: Within chapters, provide specific reference to related information in other chapters. That is, do not simply say, "see Chapter 25" but rather indicate the specific page number(s) and the crucial words the reader should search for.
>
> **Recommendation 11**: In the index, use boldface to aid the reader in the progression of the entries. The number of subentries under primary topics makes it difficult to track the alphabetic progression, even with indentations. Boldface at the beginning of each alphabetic category, i.e., a boldface "A", "B", etc., or presenting the primary entries in boldface would aid in the tracking.
>
> **Recommendation 12**: Develop a consistent organization and heading system for the chapters. It now appears that each chapter is written and formatted individually.

MSTS was considered by most users as the "reference of first resort". It is the first reference they turn to for information, and its scope is viewed as comprehensive. While the book was a consistent first choice, respondents complained that the book did not provide them with follow-up resources--more detailed or alternative presentations. The failure to at least provide a means of accessing more detailed information not only makes the book less usable but it creates a negative image for the book. That is, readers view the intent to be one of "hiding" details because they are proprietary--hardly an image one wants for a basic reference book.

> **Recommendation 13**: Provide a meaningful bibliography and reference list. Tell the readers where they can get the most current detailed information on each topic in the chapter. One-fourth of the chapters in

the ninth edition do not even have a reference list or bibliography. In many of the other chapters, the bibliography is hopelessly out of date.

FINAL REMARKS

Throughout the interviewing process, we were amazed by the amount of goodwill that readers expressed towards *The Making, Shaping and Treating of Steel*. Some of that goodwill comes, no doubt, from the low price that the book was distributed for by United States Steel. Though we have no figures to support this claim, we suspect that the amount that United States Steel lost directly by subsidizing the book was more than compensated for by the intangible asset of *goodwill* generated by the book.

On a scale of 1 to 5 (1=very good, very useful, 5=throw it out the window), our readers rated the book at an average of 1.8. We believe that there are ways to improve that score.

'The Making, Shaping and Treating of Steel'

INTRODUCTION

Purpose of the Study

The research reported here was designed to provide preliminary data on the use of the reference text, the *Making Shaping and Treating of Steel* [MSTS]. The data is meant to better define the audience for the book and the way in which that audience uses the book. The findings are seen as having three uses:

1. The data, and the methodology employed, can be used to design a more intensive data collection effort e.g., what subgroup[s] to focus on and what aspects of the use of the book should be explored in depth.

2. The findings may be used as input for the redesign of any future editions of MSTS to make it a more usable reference text.

3. The data will provide a data base for improved marketing of the book, identifying not only who the audience is but why and when they obtained their current copy of the book and what they see as the strengths of the book.

We must include the following caveat, however, regarding the latter two uses of the data: The sample used in this study was small--especially small in terms of any particular subgroup of users. Therefore, the findings must be considered to be preliminary and only suggestive of what might be found in a more detailed analysis.

Background

The *Making Shaping and Treating of Steel* is a landmark book in the steel industry. It is viewed as providing the most comprehensive coverage of the steel making, shaping, and treating processes, and has been through 9 editions with the first edition being published in 1919. The wide distribution of the 9th edition, more than 38,000 copies worldwide, is testimony to the centrality of the book in the steel industry. The text for that edition was 1301 pages (approximately 490,000 words) with approximately 22,500 entries in the index.

While the book has a long history and wide distribution, very little is known as to who uses the book. The only distribution data available is from the 7th edition published in 1957 which indicates an equal proportion of copies to academia, overseas producers, and domestic producers. However, simple distribution statistics do not provide any information on **whether** the book is used; or if it is used, **how** it is used. It may be, for example, that because of its inexpensive price and because of the centrality of US Steel in the industry, it is a reference text that everyone simply keeps on their shelves because it is a book everyone "should have". Or it may be that engineers acquire the book as part of their university course of study, but simply keep it on the shelf once the class is completed. That is, the book could be an excellent instructional text but nevertheless be extremely inadequate as a reference text.

The *audience* is a basic component in the communication triad. That is, there is not just a writer (speaker) and a text (message), there is also an audience receiving the information in that text. That audience is not passively receiving the message, but rather they are using the text as a tool to augment information they already have. Thus they use their knowledge of the structure of text and of the subject matter to locate relevant information and to interpret the information that they locate. An effective writer, and an effective text designer, will design the text to accommodate the audience needs--to make the text usable. Indeed, a text will only be used to the extent that the author meets the needs of the audience.

While in general it is obvious that the effort expended to produce a volume of the magnitude of MSTS demands that the book address audience needs, today that requirement is even more essential than in the past. Previous editions of MSTS were widely distributed at a fraction of the cost of development. It was basically a contribution by USS to the steel industry. Today's economy, however, dictates that the book must pay its own way--it must at least break even.

A reference text presents special problems in audience address since there is typically a diverse set of users; diverse in terms of the knowledge base they bring to the text as well as in terms of the types of information they require. Informal discussions as well as the distribution statistics given below suggest that this diversity of users is clearly true for MSTS. Given knowledge of audience use, the writers and designers may be able to accommodate all of the needs in the single text, or multiple texts may be required, or it may simply be necessary to define a subgroup or subgroups as the target for the book.

If there is not accurate data on the users of MSTS, how then have the requirements of the audience been identified and accommodated? Basically the book is written within the steel industry, for the steel industry. Thus there is a presumption that simple self-examination of information needs will provide sufficient insight. Steel engineers write the chapters. The engineers are members of the audience and hence might be expected to understand the needs of the audience and hence might be expected to understand the needs of the audience. However, the engineers (primarily research engineers) represent only one small segment of the audience receiving the book--how able are they to assess the requirements of the broader spectrum of users? Even in terms of an audience of research engineers, how able are the writers to view the audience as separate from themselves? That is, are they able to distinguish between the knowledge and inferences they have made in interpreting and writing the text, and what is in the actual text as written?

The first issue in designing this survey was simply to identify who uses the book and where and when they obtained it. What is the range of users across

professions within the industry (metallurgists, salesforce, facilities engineers); across different segments of the industry (suppliers, manufacturers, academics/researchers)? Did they obtain the book on the job or in school? Did they buy it themselves? What edition do they use? All of these questions will define the audience in a way that should be primarily beneficial to marketing.

In terms of the second issue, text design, the concern is not so much who uses the book as it is how they use it and what knowledge they already have when they come to the book. In essence a usable text will match the audience needs on four dimensions:

- Breadth of coverage
- Depth of coverage
- Access
- Comprehensibility

We designed the survey to assess the adequacy of the text on each of these dimensions. A hallmark of MSTS is that it addresses all aspects of the steel processes. Thus we certainly expect the book to have *breadth of coverage*. However, we may find that the breadth of coverage is a hindrance. If, for example, readers only use the book for a particular subject area they may find the bulk of the book to be cumbersome.

Depth of coverage is a dimension where we may expect significant commentary relevant to design. There are several issues here. Does the coverage include current technology or is it out of date? Are the historical descriptions adequate? Are they useful? Does the description of a process or component address the relevant features (function, physical characteristics, procedure for using, etc.)? Is the level of detail of that description adequate?

The *access* issue has to do with how easily the necessary information can be located. This includes the adequacy (and the tendency to use) the index and the table of contents to locate information. It also includes the adequacy of the text-graphic cross cueing, the subsection headings, and other structural cues within a

chapter. Finally, it includes the degree to which the necessary information is co-located-- opposed to having to obtain parts of the information from 2, 3, or more different sections of a chapter or even from different chapters. This is basically a question of whether or not the organization of the material meets the reader's organizational needs.

Finally, *comprehensibility* refers to whether the information is presented in such a way as to be easily understood. Is the display format the appropriate type for the information use? Display types include prose, graphs, tables, photos, and line drawings. Given a display type, how easy is it to understand? Is the style appropriate?

In addition to specifically focusing on the above four dimensions of usability, we asked open ended questions soliciting suggestions for improving the coverage and the design of the book.

METHOD

Respondents

The first task was to develop a taxonomy reflecting meaningful distinctions between the different individuals using the book. By "meaningful" distinctions we mean that there be some expectation that individuals in different categories would use the book in different ways to achieve different goals. The taxonomy that evolved was based on an analysis of the categories in the *Directory of Iron and Steel Plants* [the Association of Iron and Steel Engineers, 1984], the suggestions from the editor of *Iron and Steel Engineer*, and our own intuitions.

The resulting taxonomy involved two dimensions, one involving the industrial segment in which and individual was involved and the other involving the particular job classification within that segment. The categories of industrial segments were: [1] integrated steel producers, [2] specialty steel producers, [3] large suppliers, [4] small suppliers, [5] academia. The categories along the people dimension were: [1] metallurgists and research engineers, [2] civil, mechanical and electrical engineers involved in both steel and other areas, [3] steel engineers, [4] operators, [5] academicians, [6] sales people, and [7] students. There were, of course, empty cells in the matrix, e.g., the people category of academician only intersects with academia.

The categories identified, as well as the people interviewed, were restricted by the fact that all interviewing had to occur in the Pittsburgh area. In terms of categories this meant first of all that no mini- and midi- mills were represented. Such interviews would have been helpful because of the advanced technology typically employed in these mills. Secondly, it meant that the overseas portion of the industry, a major recipient of recent editions of MSTS as well as a major factor in the steel industry, was not represented.

In selecting a sample of individuals to interview an attempt was made to represent the categories of the matrix, and hence the population of potential users, rather than sampling intensely within a particular cell or category of the taxonomy.

The selection of actual companies and individuals within the companies was based on two criteria in addition to the Pittsburgh locale requirement. First, the individuals and companies had to volunteer to participate. Second, the individuals had to have used the MSTS in the last 4 months. We selected companies from the *Directory of Iron and Steel Plants* based on our criteria and the suggestions of the editor of *Iron and Steel Engineer*. We contacted a company representative, again based on the information in the *Directory*, explaining our task and the types of people we wished to interview. It was the company representative who then served as a liaison between us and individual interviewees. To avoid problems of possible bias, no employees of US Steel were interviewed.

The final sample of companies included two large suppliers and one company in each of the other categories. The small supplier provided electrodes to the industry while both large suppliers provided both equipment and services. A total of 19 individuals were interviewed across the seven companies: 3 were involved in research and development; 2 were steel engineers; 6 were civil, electrical, and mechanical engineers not exclusively involved in steel; 3 were operators; 2 were academics, and 3 were salespeople.

Questionnaire

The interviewer used a questionnaire to guide the interview. A variety of question types were used; however, the respondent could elaborate upon any question and thus it was basically an open ended question format. In those cases where a "rating" was requested, e.g., how difficult or how important something was, a five point rating scale was employed.

The questions were divided into four categories: [1] Background questions involving relevant characteristics of respondents, edition of book used, number of years used, etc., [2] questions of last usage, [3] questions of general use, and [4] problems and suggestions for improvement. Questions of last use and questions of general use were used to cross check responses and to evaluate alternative methodology for assessing how a text is used.

The questions concerning the last use of MSTS basically involved requesting the interviewee to recreate the context of that usage. They describe what they were doing, why they went to MSTS, and then actually take out the book and indicate the particular pages used and the particular information taken from those pages. Finally they indicate the adequacy and the use of the information. This interview strategy has the potential benefit of providing specific examples of last use which will be less tainted by the tendency to give idealized information (how the individual "should" or would like to use the book). The idealizing bias is a potential problem in the section of the questionnaire on general use. The last use questions presume that the respondent can in fact remember and recreate the last use. The memory of an event is obviously not a fully accurate account, but rather some things are forgotten and others are embellished as the individual attempts to recreate the event. For this reason any such reporting must be treated cautiously. We are presuming that the reporting of basic activities will be reasonably accurate.

In both the questions of last and general usage as well as in the solicitation of suggestions for improvement, the questions revolved around the four dimensions of usability, the adequacy of the: depth of coverage, breadth of coverage, information access, and comprehensibility. The appendix contains a copy of the questionnaire that was used.

The questionnaire took approximately 50 minutes to administer.

RESULTS

Who uses Which edition When

A critical question for marketing purposes is the proportion of people in each of our categories who use the book. Because of the small sample in this pilot study and because we restricted our interviewing to individuals who reported using the book, we cannot provide firm data on this question. However, relevant to the scope of audience issue, is the fact that we never encountered a person who had not at least heard of MSTS. We had to reject a few potential interviewees, but only because they had not used MSTS in the recent past.

We questioned readers concerning the edition they used, how they had obtained the book, how long they had been using the book. Readers were split as to when they had obtained the book:

- 42% had obtained the book while at school
- 58% had obtained the book either at their current job or at a previous job.

Readers had been using one or another edition of MSTS for a median of 12.5 years. Those involved in production at a mill had used the book 18 years on average, while those involved either in research and development, or supplying to the steel industry had used the book for a median of 9.5 years, and 7.5 years respectively. These are high figures, especially for those working at the mills. It indicates that many did not possess the latest edition of the book.

In fact, 39% did not possess the latest edition, even though that edition was published in 1971, 14 years ago. Perhaps more worrisome is the fact that of this number, almost half (43%) did not know of a more recent edition to the book. Apparently there has been some failure in advertising or marketing along the way and in future editions this should be corrected.

There is a correlation between when readers first use the book, and which edition they possess. Thus, those who do not possess the 9th edition have been using MSTS for a median of 20 years, years, while those who do possess the 9th

edition have been using MSTS for an median of 7.5 years. Roughly speaking then, *when people buy the book, they buy it for life.* And when the book is bought for life, the user may have little knowledge of the extensive advances in the steel industry that are updated in successive new editions of MSTS. This should be kept in mind when evaluating the market for future editions. Ways must be found to make readers aware of the changes that the book undergoes.

It should also be kept in mind that very few people bought the book out of pocket at a price reflecting its true production cost. Those who first received the book at school spoke of a "special deal" that United States Steel had for acquiring the book. They thought the book was more or less a bargain. Many of those who first received the book at the workplace were given the book when they came on the job. Thus, for example, a Vice President at a small supply company presents all his salespeople with a copy of MSTS when they commence work.

Only two persons admitted to not buying the 9th edition of MSTS because of cost. Still, for many we expect that the price of new editions will be prohibitive. Unfortunately, we did not ask all readers whether they planned to purchase the upcoming edition. Quite a few did ask about publication price. All seemed very happy that the book was being updated, not a few expressing real surprise that such an undertaking was being carried out given the current state of the local steel industry.

Almost everyone we talked to also knew of other colleagues that used the book. On average, each user we interviewed knew of nine others that used the book.

What sort of information are people looking for?

MSTS presents information of many different sorts: specific information concerning the particulars of a single mill, general information concerning the overall processes involved in the production of steel, etc. In order to be a successful book, one that is of maximal use to its users, we must know not only the sorts of information that the book contains, but also the sorts of information

that people are looking for in their day to day use of MSTS, what these users say they need or want, and what their recent usage suggests that they, in fact, use.

Only one person we talked to found that the depth and breadth of coverage in MSTS was excessive. Almost twice as many respondents found the depth and breath sufficient as found it lacking. (61% found depth and breadth sufficient, while 33% found it lacking.) Still, many did find it insufficient. This is especially noticeable among those involved in production, where 60% found the breadth and depth of coverage insufficient. We will later comment on specific suggestions made by users to improve coverage.

Readers consult MSTS for a variety of reasons. Virtually all of the respondents told us that the book is their *standard reference of first resort.* However, the types of information they require varies:

- 61% of the respondents were searching for information *outside* of their area of specialization during their last use of the book.
- 39% of respondents were searching for information *within* their area of specialization.

We had not expected such high use within respondents' area of specialization. This suggests that the book is used as much more than a broad based introduction to steel. This is especially true for those involved in production, where 60% of the information searched for was *within* the respondents area of expertise. These Respondents rely on MSTS for information about which they already have expertise. Those involved in research and development on the other hand reported always searching for information *outside* of their area of specialization. This difference in use of MSTS is especially important when we consider that those involved in research have typically been the chapter authors while those involved in production probably represents the largest body of users.

We asked respondents to characterize their goals in looking for information. Results were as follows:

- 49% use the book to get a general understanding of the way things function, look, work
- 37% use the book to get specific information when the general idea is already clear

- 14% use the book to figure out how isolated aspects of the steel industry fit together

In the sections that follow we look at these audience needs for specific and general information in more detail. We will first look at user needs for *general* information. How and when do they use general information? When do they need general *historical* information? Second, we look at user needs for *specific* information. We then consider the perception of MSTS as an *educational* tool. Finally, we consider the types of information which users feel might be in the book, but is missing.

Editors and writers of necessity have opinions about what should and should not be in a book. It is essential for marketing strategy, however, to also consider how their interests correspond with the interests and needs of the user. The questionnaire has offered us some insight along these lines.

Requirements for General Information

Respondents felt that 63% of their time was spent in gaining either general information, or information about how isolated aspects of the steel industry fit together. Indeed, it is this very general sort of information that most view as the hallmark of the book. When queried as to strengths of the book, many took up the theme that the book gives the best "general description of the basic steel industry." It gives a "good description of all aspects of the steel making process in reasonable detail." It's a "steelmaking encyclopaedia good for the basics, but not for advanced steelmaking." It helps one "get into the industry." The book is a "jack of all trades, master of none."

How and When Readers Use General Information: Typically, our respondents would use MSTS at the initial phase of some project. Often the impetus to go to the book comes from a query from salespeople, colleagues, customers, subordinates. For example:

- A sales person calls the main office from out in the field. He hears of a change at one of the steel plants that could possibly affect the supplier's industry. He knows nothing about the layout of the particular kind of plant under discussion. Either he will consult MSTS or an engineer back at the main office will consult it.

- An operator or manager who isn't technically oriented approaches an engineer with questions. The engineer looks in MSTS to explain the problem, perhaps assigning the operator to look over a section of the book himself.

- A customer has a question about steels for application and the reader "goes to MSTS to look smart."

These sorts of *task oriented* uses of the general information in the book are not uncommon and should be kept well in mind for future revisions of the book: People go to the book because someone confronts them with a problem that they must solve (or at least act as if they understand). The book gives them a "rough and dirty" idea of what is happening and of what they should do. Even "general information" is quite specific and therefore the effective use of locating and access devices--headings, detailed tables of contents, and the index--is essential to this general use.

There is a second use for the general information. Readings that are not task oriented are often associated with browsing for the sake of browsing. Such a use is less common, only ten percent of respondents mentioned this use. "I refer to the book for my own education. I browse in it." "I'll need to brush up on my general chemistry or on terminology."

When we questioned readers about their last use of the book, none were simply browsing in the book. All had specific tasks before them. Still, the browsing does relate to a perceived function that readers believe the book fulfills, that of providing a broad general *education* on the making, shaping, and treating of steel. We will return to this later in the report.

Historical Information: Part of the general information that readers require is background historical information. Fully 68% of the readers said that they had read parts of the book containing historical information while even more individuals, 79%, said that they thought such information was necessary and should remain in the book. All those involved in production at a mill felt the historical information to be necessary, with slightly less commitment [75%] among those in research and development and less commitment still [63%] among suppliers to the steel industry.

There were some objections to and suggestions for improvement for the historical sections. An engineer at a large supplier to the steel industry felt that one did not get a good idea of the "flow of history." As a specific example, he cited the discussions in the book of BOP and Q-BOP. After reading the sections, he still had no idea why the industry made the historical transition from BOP to Q-BOP.

An engineer admitted that when he started work he didn't even know you had "iron before steel." Even such very basic information is learned from this book.

One academic remarked that though he wasn't sure that the historical information was essential, he did feel that the steel industry had a tendency to repeat past mistakes, and insofar as the book could prevent such errors by containing sections on history, it was all to the better.

He also felt that some of the historical information read too much like a history of United States Steel. In future editions this could be avoided, through descriptions based on a much more international perspective. Also, all historical information that has clearly not affected the course of the standard practices of the steel industry should be left out.

It is important to remember also that the historical information is used by a good number of people who are only marginally connected to the steel industry. Still, these people must talk to those involved in the steel industry, and know where they are coming from. A specialty supplier of electrodes could not be expected to know what processes were current in the steel industry before VAR, ESR etc., though he must deal with people who may know that past better than the current technology. We have observed MSTS as a kind of meeting ground for these different people.

In summary, the historical information is highly valued and used. Furthermore, with the rapid turnover of employees and changes in the industry, historical documentation should become even more important. If the historical information is to be part of the MSTS chapters, then it is important that history

be clearly designated as such and that the historical flow is clear to the reader. Specific dates or time frames should be used rather than such terms as "current," "modern" or "in the past." The historical sequence may be obvious to the old timers in the industry, but, as we have remarked previously, there are very few old timers anymore. The historical presentation in MSTS will be the "old timer" of the industry.

Many people remarked that they enjoyed the historical information in the book, even to the point of taking the book home and reading it at bedside!

As an alternative to, instead of, or perhaps in addition to, the inclusion of history in the MSTS chapters, AISE should evaluate the potential for publishing a smaller volume containing just the historical information. The historical information is clearly of interest and is used, yet our readers seemed unaware of an alternative book that offers a good history of the steel making industry.

Requirements for Specific Information

On the average readers reported that 37% of their use of the book is to obtain specific information, i.e., a specific fact as contrasted to an overall description. This is consistent across subgroups. Of the total information required, 27% of the information required by those in production, 21% of the information of those in research and development, and 44% of the information of those supplying the steel industry was characterized by respondents as being of a specific nature. Engineers, whether working in steel production or supply require specific information fully 50% of the time.

Without a larger audience sample, we hesitate to draw conclusions here correlating the various audiences and their needs for specific information. There is some evidence to suggest that the above statements underestimates the extent to which the book is used for finding specific information. For example, operators said that only 11% of the information they required was of a specific nature. Yet in their open ended replies to many questions they dealt at length with what they viewed as shortcomings felt in the book's handling of specific information.

Furthermore, as discussed previously, 39% of the respondents indicated that their typical use of the book is to obtain information within their are of specialization--and it is a reasonable inference that the information required within one's own area of specialization will be quite specific. Finally, as we will discuss later in the report, when asked to identify the pages read and the information used in the last use of the book, the respondents very consistently indicated a small segment of text, suggesting a specific information requirement. Perhaps all that can be said is that users do in fact require specific information from MSTS, and rather than sighting further statistics it would be best for us to present some typical examples of the kinds of specific information they require.

When we speak of the need for more specific information here, we are not talking about depth in an *academic or research* sense, but rather about very *practical*, performance sorts of information. Consider some typical examples:

- One informant at a large mill required hands on information on getting from input to output of ingots, including energy requirements, guidelines on number of passes, horsepower requirements, etc. Though this type of information is supplied, e.g. in Chapter 23 of the 9th edition, apparently it is not found in the detail needed.

- Similar complaints among operators were found for the chapters on rolling and on semikilled steel. One operator remarked that he needed more on specifications for semikilled steel (very specific specifications-"silicon at 4, aluminum conditions" etc.).

- Similarly, there were requests for more information on power design for rolling mills, duties of rollers, factors affecting rolling, gear ratios, dirty oil, load requirements for electric furnaces, maintenance requirements for welding repairs, etc.

While it is doubtful that all the sorts of specific information alluded to by readers can be carried in a book of this size, it is of crucial importance that these readers at least be told where to go to find such information. One operator admitted to using the 4th edition for such information, even though he owned the seventh edition of the book also. A retired academic also felt that an earlier edition (the 8th edition) was superior to the 9th in this respect. It was his feeling that though the book was good on qualitative description, it was terribly "secretive about giving any real information." Much of this information, he maintains, may

"seem proprietary" at the upper levels of corporate structure, but in fact isn't at all. It would hurt no one to include such information.

The Appendix: The type of specific information needed seems to us not to be of the type that is typically found in handbooks, such as *The Handbook of Chemistry and Physics*. Such specific information as periodic table of elements, physical properties of elements, SI factors for commonly used physical units is to be found in appendices to MSTS. We found that only a third of the respondents had ever used the appendices and a large number of the remainder were not even aware that the appendices existed. 50% of the respondents did feel that the appendices should be there. Nevertheless, respondents' real life behavior suggests that they would likely not use the appendices in any case even if they knew they were there.

Most of the users who required the type of information found in the appendices knew of other places they could find it with less trouble. In addition to various tables available in-house, readers used individual data sheets published by *Alloy Digest*, a book on *Steel Analyses and Useful Data*, published by Bethlehem Steel, and a book on *Useful Tables of Weights and Measures*, published by Mesta Machine Co.

One must question, however, why it is that readers do not go to MSTS for such information even though they view the book as a reference book. Part of the problem here seems to be simply the weight of MSTS. Informally we noted that many of the charts and tables that our respondents used were to be found in small pamphlets or booklets. It does not seem that any great effort should be expended for future editions in reproducing the type of information that readers can easily find elsewhere. Nevertheless, with a minimal effort, readers can be subtly forced to use the appendices in MSTS more often: references to the appendices could be made in the chapters at points where readers are likely to need such information. Also in the Table of Contents, the appendices could be set in a larger or different type set so as to stand out and be readily distinguished from chapter titles.

The Bibliography: As we have said, specific information must be

somewhere available to workers in the steel industry. The bibliography is a useful source to gain specific information not present within the text itself. We found that the bibliography is used by only 11% of users. Yet, as remarked earlier 33% found the breadth and depth of information in the book insufficient for their purposes. It is absolutely essential that readers either get the information that they need about steel in MSTS or that they be told where to go to get the needed information.

As the bibliography is presently organized, one does not know which articles are important, which peripheral. Yet in interviews, it seemed clear that almost every aspect of the steel industry has its own "best" book. MSTS should not feel reticent in endorsing certain books as such. That is, the bibliography could in addition to straightforward bibliographic information contain comments of the following sort: "For an in-depth analysis of of the electric arc furnace see *The Electric Arc Furnace*. 1983. International Iron and Steel Institute." Or then again, "specifications are revised and updated annually in . . . " Such information would considerably enhance the usefulness of the present bibliographies.

Additionally, bibliographic references may be additionally mentioned in the text itself. This is done in only a few chapters, yet adds little to the length of the text itself.

Finally, almost a fourth of the chapters in the ninth edition lack bibliographies altogether.

The above statistics, examples, and discussion of appendix and bibliography all illustrate the shortcomings of coverage of specific information within MSTS. Because the text is a reference text and must satisfy many different audiences, it will be extremely difficult to make everybody happy. MSTS must, however, either present the needed information or tell the reader where to find that information.

A worker at a large mill put it best: "What I want is a 'what if' book. MSTS quickly brings you up to speed and then *it drops you*. It doesn't tell you where to go *and if there is anywhere to go*."

It is, of course, possible to criticize those who require such specific information out of MSTS and do not know anywhere else to go. However, the criticism would be counterproductive. MSTS is not just *a* book about steel, for many it is *the* book. In the past, much of the "hands on" information required to run a mill was obtained more or less by word of mouth and by tradition. One fellow explained the hiring practices at his mill in this way: "the old timers are being laid off though new people are still coming in." If this is an accurate account, then MSTS must itself serve the function of the "old timer", acquainting the new workers with the specifics of the steel industry.

As a cautionary note, it should be mentioned that much of the specific information that readers requested concerns the everyday operation of the mill. It is quite possible that many of these mills will no longer be in operation by the time the next edition of the book is published. Indeed, the status of the mills was quite uncertain even at the time of the interviews. We suspect that operators and engineers at the new mini- and midi- mills and at new integrated mills would have less need for a MSTS packed with specific information, even if the book were updated to include comments on such mills. We did talk with some people involved with the technical documentation for the new Timken works in Ohio. The documentation for each part of that mill and each job description is extensive. If such documentation efforts are typical of the new generation of mills, it becomes less and less necessary to have such information presented in MSTS.

MSTS as an Educational Tool

Up to this point we have looked at audience needs for both specific and for general information. In most of these cases the reader had a particular task that needed to be accomplished, and MSTS helped him in the accomplishment of that task. We may also divide the audience along another dimension: reading *to do* versus reading *to learn*.

MSTS is broadly viewed as an tool for the general education of workers in the steel industry, in closely allied industries, and in colleges and universities. This perceived function is clearly enunciated in the preface to the fourth edition:

> We have aimed to supply the knowledge most useful to five different classes of readers; namely, employees of Carnegie Steel Corp., employees of the other subsidiary companies of the USS Corp., customers of these companies, students of ferrous metallurgy in colleges and universities, and the general reader who desires a work for reference...

Our interview data indicates that the book is used at the undergraduate level. In talking informally to students at the graduate level, it was felt that it could be of only the most limited use at the graduate level. It is true that 42% of the people we interviewed obtained their copy of the book in college. As discussed earlier, part of the reason for this was the very reasonable price the book was sold for at the time. In effect, the publication was subsidized by United States Steel.

There seems to be two issues involved when looking at MSTS as an educational tool. One concerns marketing to the audience. The other concerns designing the book for learning vs. doing.

Without subsidies the book will be far too expensive for a typical undergraduate class. The publishers should consider breaking the book up into sections and publishing each section in paperback.

The members of the academic community we talked to were much quicker than most to criticize the book in both content and organization. While this is perhaps to be expected (and even encouraged), it is true that the book does not lend itself easily to the type of reading that one typically must do in an academic setting. The academic use of the book is seldom simply for factual reference--for procedures on how to do something or for understanding a particular function or process--yet this is the primary use for the primary audience, members of the steel industry. In preparing a usable job reference book the focus is on ease of access and on completeness of the information. In the preparation of an instructional text the focus is on comprehensibility and on the building of knowledge structures in the reader. While these different features of "usability" need not be in conflict, there is typically a tendency to focus on one direction or the other.

MSTS seems to fill both an educational and reference role. That is, people

use the book for specific data within their specialization and for more general understanding of processes and procedures in related specialities. This general understanding, however, differs from the general understanding required in an academic classroom. That is, the general understanding on the job is driven by the specific information requirements demanded by that job. In contrast, the academic requirement is typically for decontextualized, general knowledge building. MSTS seems to fill the job specific educational role quite well. Respondents often mentioned this function of the book; the book was a means of self education, a means of educating subordinates, a means of finding a common ground between groups approaching some aspect of steel from very different angles. The book seems more of an educational tool outside of academia than within.

The Structure of the Book

Respondents were questioned directly about their satisfaction with the structure of the book. It is important to have such information when designing a text, for often times rather simple changes can be made that greatly increase the usefulness of the text for the readers' particular needs. We included questions about

- design format (text, line drawings, photographs, tables, graphs)
- sectioning of the book (chapter divisions, bibliography, appendix, etc.)
- method of finding information (table of contents, index, experience)

In such matters, respondents will often give answers based not so much on how they actually use the text, but on how they think they should use the test. To control for this possibility, we had respondents recreate their last use of the text. We could then compare the way that they did in fact use the text with the ways that they felt they used the text.

Design Format

Information presented in the book may be in various forms: paragraph, table, graph, photograph, line drawing. We asked readers how often the information they needed was found in each of these display types. The paragraph was most often indicated as the source of information (48%), with the other design formats splitting up roughly equally.

Respondents rated all design types at around 2 on a scale from 1 to 5 (1=the information presented in this form is very useful, 5=the information presented in this form is not useful at all.) Average ratings were text(1.7), line drawing(1.8), table(2.0), photographs(2.2), graphs(2.3).

Despite the comparatively low score given to photographs, respondents often remarked on the high quality of the photographs. One problem, however, is that in many photographs there is no indication of size. To alleviate this problem, a scale could be drawn superimposed on the photograph. Alternatively, if the photographs were to have people in them, scale would be obvious.

Graphs and tables should function in text as complimentary ways of presenting information. While the table gives exact specifications, the graph gives a feeling for overall correlations between various parameters. A reader can be expected to have some difficulty if trying to obtain exacting information from a graph (see for example Fig.19-9 on the carbon-oxygen equilibrium relationship). Research generally suggests that graphs are more effective than prose if the writer has a specific information requirement; tables are most effective for interpreting whether a given numerical value is more than some critical, baseline value; and tables are better than graphs for presenting quantitative data, but not for showing trends. Research also suggests that tables are much more suitable to professional audiences than to general audiences (see *Guidelines for Document Designers. 1981. American Institutes for Research*).

Research also suggests it is a good idea to present information in more than one format. For example, what is described in detail in a text is also shown in a line drawing and photograph. Care should be taken that wording across formats

remains consistent. A vacuum tank discussed in the text should be listed as a vacuum *tank* in diagrams, and not as a *chamber*. If *tank* and *chamber* are indeed synonymous, the synonymy should be mentioned in the text itself.

During the layout of the book, it is important that insofar as possible text and accompanying photos, line drawings, etc. be found on the same or opposing pages. In examination of several chapters of MSTS we found that this was frequently not the case. For example, in Chapter 1, the initial text reference to a graphic and that graphic were not on the same or opposing pages in 32% of the cases. This failure to co-locate reference and graphic was 33% for Chapter 15, 43% for chapter 16, 30% for Chapter 17 and 18% of Chapter 18. Though some of the layout problems were unavoidable, many were not.

We did receive a few specific suggestions for information format. One reader appreciated the fold-out line drawings found in the seventh edition. A drawing such as Figure 23-33 summarizing output options for a blooming, bar, and billet mill is very useful for the audience requiring the *specific* operating information that we have alluded to previously.

Access: How Readers Find Information

Readers felt that they had little difficulty in finding information in the book relative to other books that they used. On a scale of 1 to 5 (1=information is very difficult to find, 3=the book is just like any other book, 5=information is very easy to find) readers' average rating for the book was a 3.8. That is, the book is somewhat above average in terms of ease of finding information.

In looking for information readers employ three strategies: they use the table of contents, they use the index, they roam about the book using only their prior experience as a guide.

We asked readers to rate how important they viewed each of these ways of finding information on a scale of 1 to 5 (1=very important, 5=not important). The index was rated most important(1.8), followed by the table of contents(3.1) and prior experience(3.1).

When we watched readers reenacting their last use of the book, we found that experience, in fact, played a larger part than users of the book believed it did. That is, readers tend to over report their use of the index and table of contents. One third of the respondents reenacted their last use of the book by browsing through until they hit upon the information they had used. All of this group subsequently claimed to have used the index on their prior search for the information. We suspect that readers said they had used the index partially because that is the "correct" answer to give.

The readers' search strategies do provide clues to design format of the book. The index is clearly the most important. We had suspected that readers would object to index formats of the form: *Troughs, Iron* see *Iron, troughs.* In fact, only academics and AISE officers objected to this extra step in the search process!

Because of the length of the index it is very easy to lose track of whether one is looking at a major heading or a subheading. Simply introducing each new letter of the alphabet by a large bold letter can help alleviate this problem. Major headings can also be printed in slightly larger type or with bold lettering. Putting major headings in all capital letters will increase rather than decrease confusion.

We found that the table of contents was used by only 31% of the readers, and half of those were subsequently unsuccessful in finding the section that they required. There is thus a lack of preference for the table of contents and this may be due to inadequacies in the way it is structured. Many of the titles in the table of contents are not descriptive enough to give the reader an idea of the contents of the chapter. For example, *Steel Ingots.* Other chapter titles are not sufficiently differentiated. For example, *Construction and Operation of Rolling Mills* vs. *Production of Steel Blooms, Slabs, and Billets.*

Previous editions had a much more detailed table of contents, and such a strategy could again prove useful.

When readers did find the general area of the book that they needed, they tended to read over only 2.25 pages during the reenactment of their last usage of

the book. When we questioned readers not on their last use but as to how much they *usually* looked through in the process of finding the information they needed, 17% said they only used one page, 47% said they had to look over several pages. None said that they usually read through most of a chapter, while 35% claimed to look through sections in several different chapters.

Of the pages readers had last consulted 58% claimed to have given the pages a close reading, whereas 42% claimed to have just skimmed through. Still, this is a very small number of pages to read through. This small number of pages consulted does have design implications:

- It will do little good to have chapter summaries or outlines at either the beginning or the end of the chapter. Chances are the readers would not see these summaries in any case.
- It will do little good to worry excessively about redundancy in the text. Chances are the reader will not consult enough of the text to even notice the redundancy.
- It will do little good to use references such as *see Chapter 23.* A reader will not carefully consult all of Chapter 23. Thus, references should be of the form *see* **Squirrel-Cage Motors**, *p.639.* Headings should be typeset as they are typeset in the chapter being referenced.

Though we may wish that readers were better behaved in their search strategies, there is very little we can do on that score. Thus, we should try to be as accommodating and helpful as possible, given the constraints the readers place on us.

In addition to the Table of Contents and Index, two further ways of finding information should be again mentioned: bibliography and appendix. We have discussed both in some detail already.

The Glossary: One way of displaying information that is not employed in the book is the use of a *glossary*. Several readers spontaneously suggested such a format and others, when queried, seemed to find the idea a good one. Given the breadth of MSTS it may be that such a glossary would need to be published as a separate volume. In any event, a well structured index already acts as a way of accessing the definitions found throughout the book.

The possibility of publishing a separate glossary reveals once again that

MSTS is not a book whose audience is homogeneous, all of whom go to the book for the same kinds of information. MSTS, in effect, is a book that must make all groups of the steel industry happy, even though those groups differ greatly as to education and job description.

CONCLUSIONS AND RECOMMENDATIONS

Marketing

Our results suggest that many readers were not aware of the publication of the ninth edition, 14 years ago. Furthermore, many readers who owned the ninth edition preferred and used earlier editions for many types of information. In essence, there does not seem to be a feeling of a need for currency in the kinds of information presented in MSTS.

A further issue of coming editions will likely be the cost of MSTS. Many of our respondents reported receiving or purchasing the book in school, but if the book is to be priced at a fair market value, it will be out of reach for many students-to-be-engineers.

On the positive side, MSTS (in one edition or another) is widely used and is viewed very favorably. It is indeed considered the "reference of first resort," thus indication the positive value of the comprehensive nature of the book. It is also rated very highly in terms of "usefulness."

Because of the costs and because of the relative lack of a felt need to have a "current" edition of MSTS, (future) editions of the book should involve a very detailed user analysis to insure that user requirements are being met. Suggestions as to how such an analysis should be conducted are presented in the next section.

Future editions might also be broken into sections on making, shaping, and treating which could be bound and marketed separately. While this strategy would reduce the price of the book, there is the potential that such a breaking up of the book would destroy the mystique of MSTS and thus have a long term negative impact. We would recommend that any partitioning of the book should be in a lower quality paper, covering and pages, to contrast with the complete, "real" MSTS. Such a prestige approach could even enhance the image of MSTS.

Marketing the (tenth edition) must not only focus on getting the word out but also must tell the potential buyers what is new in the the tenth edition. This can not be presented in gross generalities, e.g., "up to date review of production

procedures." Rather, specific information, perhaps including examples, must be presented. We asked readers to identify the important areas of specific information which MSTS does not address. To the extent that these topics are covered in the tenth edition, they might be referenced in the advertisement. (Since this was a pilot study with a very small sample, specific suggestions may be from only one individual and hence must be evaluated in that light). The particular topic areas readers of early editions proposed as requiring more detailed coverage are:

- environmental issues;
- continuous casting;
- comparison of ladle and teeming practices;
- automation, automatic control of rolling operations;
- control, on-line process control;
- VAR and ESR processes;
- specialty steels (also sections on stainless steels is not up to date);
- mechanical property testing;
- powder and powder processing;
- foaming slag, plasma arc, KR process;
- electric furnace;
- soaking pits;
- the economics of steelmaking;
- quality control;
- comparison of practices in different countries.

There are two possible ways of addressing the cost issue. First, in advertising emphasize the company's responsibility to make this "reference of first resort" available to all employees. The model for this is the vice president of sales we interviewed who said he bought a copy for each of his sales force.

A second strategy for accommodating the cost of the book is to market paper covered chapters or sections in orders of ten or more for academic use.

Academia was typically the first contact with MSTS for our respondents. Further, the distribution statistics for the seventh edition indicated that academia was a major share of the market. If the book is now too expensive for that market, then there is a potential that another book will replace it. The sale of isolated chapters or sections may aid in retaining that market.

Finally, there is a potential for marketing the history sections of MSTS as a separate book. Our respondents indicated that they were not familiar with any book on the history of making, shaping, or treating steel. Further, the historical information in MSTS was very well received. Thus a small volume, based on material from MSTS would have low development costs but might well enjoy significant sales. Of course, it must still be determined which historical books are available.

Audience Analysis

The present study was a pilot study to identify the audience for MSTS, how they use the book, and what they see as the strengths and weaknesses of the book. An audience analysis directed at the development of a future edition would build on this data, but would be far more targeted.

As noted in the introduction, the increased cost of MSTS makes the issue of targeting the needs of the audience ever more essential. Data from this pilot study reinforces that view. That is, we found that researchers use MSTS in very different ways from the majority of the audience. While the researchers are looking for general descriptive information outside of their area of specialization, the production people are looking for more detailed information within their area of specialization. Thus if the writers of future editions are to be research engineers, then a methodology must be established to insure that they understand and can evaluate the needs of the primary audience.

Detailed sales records for the tenth edition are the key to identifying the primary audience for MSTS. The primary reason the current study had to be broad based (in terms of individuals interviewed) was the lack of any sales data

for the last two editions. We simply were uncertain as to who used the book. While we know that it is widely used, we still cannot identify the primary audience in any detail.

Prior to beginning work on a new edition, the primary audience (or audiences) would be surveyed. Many of the issues would be the same as in the current survey. However, less attention should be given to the display of information (tables, graphs, text, etc), how information is obtained, or the broad class of information. The information is these areas seems to be consistent in this survey and will be discussed in the next section. What is needed is information on the adequacy of the specific topic coverage. What topics need to be covered, what topics need to be covered in greater depth. This information could be obtained via a survey form in *Iron and Steel Engineer*.

A critical step in the audience analysis is the review of the chapter plan and the draft of the chapter. In our preparation of ten chapters for MSTS we conducted detailed interviews with subject matter experts, first identifying the shortcomings of the chapter from the last edition (what topics are missing?, what topics require expanded coverage?) and on the draft of the new chapter (is it accurate? is the depth of coverage adequate?). Our interviews were with potential authors of the chapters, typically research engineers. However, the analysis should also have been conducted with the primary user group, had the group been known. There are two reasons for this. First, the primary user group is the group that will ultimately reject or accept the book based on adequacy of the breadth and depth of coverage. Secondly, our data indicates that the research engineers, the primary authors of the chapters in the past, have information requirements that are very different from the other audience groups. These interviews need only involve a couple of hours for two or three people on each chapter.

Design for Future Editions

The findings from our pilot survey suggest that the primary use of MSTS is directed at obtaining specific information to a surprising extent. Even in those instances where the use is described as seeking "general" information, the reader typically only makes use of the information on a single page. There is seldom any jumping around between chapters or even within chapters.

Information Displays

The information actually obtained comes from text about half the time and from graphic displays of various sorts the rest of the time. All of the displays are rated quite highly and the readers do not suggest any changes in the use of the various display types (text, graphs, tables, etc.). None of the display types were considered difficult to use or understand.

These findings indicate that the same style can be maintained in future editions--style is not a problem. However, the reader reports are not entirely consistent with research findings. While the respondents report that information is obtained from text at least half of the time and that the display type is adequate, research findings indicate that graphic displays are far more effective for obtaining specific information. Indeed, tabular and graphic displays seem intuitively to be the most useful displays for much of the information sought--procedural and specification information--especially when that information is within the reader's area of specialty.

It would be useful in planning the design of future editions to evaluate the acceptability and the usability of various information displays for the same basic information. In lieu of such an evaluation, the recommendation must simply be to carry on with the same display strategy as has been used in the past. We presume that strategy is simply to put the information in paragraph form whenever possible, using graphics to amplify the text, or when there is a complex set of data which cannot be easily described in text.

There were two specific findings regarding the comprehensibility of

information displays. First, regarding photographs, there is a need to insure that a size reference is included so that the reader has a sense of perspective. Second, regarding text presentation, there is a need to better indicate the historical development. That is, specific years should be indicated rather than simply saying "In the past" or "currently." Furthermore, the problem or opportunity that led to a change in the process or procedure should be indicated. That is, not just the change, but the reason for change must be presented.

One final comment on the coordination of information displays. Our assessment of several chapters in the ninth edition indicated that graphics and text are coordinated for less than is possible, i.e., the graphic display often does not occur on the same page or the page opposite the text reference. While our respondents did not mention this as a problem there is reliable research data that graphics are not used as much or as effectively when they are separated from the text. Thus there should be closer attention to the coordination of text and graphics in layout.

Information Access

While there was little problem reported with the comprehensibility of the display types, there was clear and frequent commentary on the amount of information presented and the ease of finding that information. The readers in general are looking for very targeted information, which means that the text must aid in that search effort. While the respondents indicate that they use the index (and that the index is effective) we observed them consistently using the very inefficient process of leafing through the pages.

We have several very specific suggestions for increasing ease of accessing information.

- Provide a table of contents at the beginning of each chapter which presents the structure of the chapter (primary and sub-headings) and page numbers. Usually the reader can determine the correct chapter, or at least narrow the source down to a couple of chapters. However, once to the chapter, the reader leafs through trying to use graphic displays as a key to the content on the particular pages. (Note that our findings indicated that readers do not go to the front of a chapter. However, we are inferring that this is because they do

not expect to find useful information there. We would expect this behavior to change with a detailed and convenient chapter outline and more descriptive chapter headings).

- Within chapters, provide specific reference to related information in other chapters. That is, do not simply say, "see Chapter 25" but rather indicate the specific page number(s) and the crucial words the reader should search for.

- In the index, use boldface to aid the reader in the progression of the entries. The number of subentries under primary topics makes it difficult to track the alphabetic progression, even with indentations. Boldface at the beginning of each alphabetic category, i.e., a boldface "A", "B", etc., or presenting the primary entries in boldface would aid in the tracking.

- Develop a consistent organization and heading system for the chapters. It now appears that each chapter is written and formatted individually. While most individuals use only a few chapters, when it is necessary to access information in an unfamiliar chapter a consistency in format from the familiar to the new would be very beneficial. There is, of course, also the aesthetic benefit of consistency in design.

Level of detail: Our data indicates a need to provide more operational detail or, failing that, to provide clear reference as to where further detailed information can be found (a more targeted and meaningful reference and bibliography system). After all, if MSTS is the reference of first resort then it should focus on directing people to appropriate second sources. The failure to at least provide a means of accessing more detailed information not only makes the book less usable but it creates a negative image for the book. That is, readers view the intent to be one of "hiding" details because they are proprietary--hardly an image one wants for a basic reference book. There are two basic strategies for providing access to detailed information.

- Include more detailed information in the chapters. An unlimited amount of detail is obviously impossible. However, a proper audience analysis, as described above, would indicate the most critical information for inclusion.

- Provide a meaningful bibliography and reference list. Tell the readers where they can get the most current detailed information on each topic in the chapter. One-fourth of the chapters in the ninth edition do not even have a reference list or bibliography. In many of the other chapters, the bibliography is hopelessly out of date.

Final Remarks

Throughout the interviewing process, we were amazed by the amount of goodwill that readers expressed towards *The Making, Shaping and Treating of Steel*. Some of that goodwill comes, no doubt, from the low price that the book was distributed for by United States Steel. Though we have no figures to support this claim, we suspect that the amount that United States Steel lost directly by subsidizing the book was more than compensated for by the intangible asset of *good will* generated by the book.

On a scale of 1 to 5 (1=very good, very useful, 5=throw it out the window), our readers rated the book at an average of 1.8. We believe that there are ways to improve that score.

Questionnaire

TELEPHONE QUESTIONS:

Mr. so and so, this is _____ from Carnegie Mellon University. We are working on *The Making Shaping and Treating of Steel* under contract with USS and AISE.

As part of our efforts we are trying to gain information on how the book is used, how successful people find the book, how they would like to see the book changed to better fit their needs. So, we're talking to different audiences: steel engineers, users, producers, suppliers, etc.

Are you familiar with that book? Do you own a copy of it? Have you used it within the last six months?

I was wondering if it would be possible to set up an appointment to interview you sometime within the next two weeks to ask you some of these sorts of questions.

WARM UP QUESTIONS: We are working with US Steel and AISE to update several chapters in MST of Steel. As part of that effort we are trying to find out how the book is used. In particular, we want to learn

a) Who uses it and how much it is used. Thus we are talking to producers, those involved in facilities development, suppliers to the steel industry, academics, and others. We want to see how the book fits in with their general line of work.

b) what kind of information they go to the book for

c) What problems there are in 1. finding information, 2. understanding it 3. adequacy of the depth and breath of coverage, those sorts of questions.

We want to use the information we get through these interviews to help us come up with suggestions about how the book might be changed so that it's truly useful to the people that use it. And we'd appreciate any help you could give us along these lines.

If I could, let me just start out asking you some questions about your use of the book:

Survey Questions

*Name_____*Company_____

*Phone_____Date_____Time_____

BACKGROUND:

1.What aspect of the steel industry are you involved in?

_____production _____academia
_____facilities development _____other
_____supplying to steel industry

2. And within that area you're a

_____facilities engineer _____student
_____metallurgist _____operator
_____teacher _____sales

3. When did you begin to use the book?

_____College _____Grad School
_____First Job _____Current Job

4.(Probe if necessary)How long have you been using the book?

Do you happen to have a copy of the book, nearby? Maybe you could pull it down. I'd like to have you show me some things in there.

5. Is that where you usually keep the book?

_____Yes _____No

6. (Where do you usually keep the book?)

_____home _____library
_____work _____other

7. How did you acquire the book?

8. (Look at book and identify edition. If not ninth, ask) Did you know there is a move recent edition of the book?

_____Yes _____No

9.Why didn't you get the more recent one

_____too expensive
_____technical changes not that great to warrant purchase
_____my edition was good enough for my needs

10. Who else that you know uses this book? (Not this particular book.)

Number_____
Kind(producers etc.)_____

RECENT USE:

11. When is the last time you used MSTS? Was it within the last

_____week _____month
_____2 months _____6 months
_____1 year

12. What are you usually doing on your job when you go to the book? That is, what are the kinds of things you're in the middle of when you go to the book?

13. What were you doing the last time you used the book? What made you go to the text?

14. Were you searching for something in your area of specialization or outside you area of specialization?

_____within _____outside

15. Could you point to the information that you got out of the book? Point to the specific information you walked away with in your head.

Page Number(s) _____

(Take notes)

16. How did you find this material in the first place?

_____already know the chapter and so knew where to find the information
_____used index _____used table of contents
_____leafed through

17. How much of the text did you use? Show me where you started and where you more or less stopped.

_____start _____stop

18. Did you have to go across chapters? _____Yes _____No

19. Did you find this _____bothersome or _____easy?

20. Did you give it a _____close reading or just _____skim through?

21. Would it have been impossible to carry on your work at that point without having access to the book? _____Yes _____No

22. Were there any other texts you could have used at that same time?

23. Why did you got to MSTS instead?

_____enough information was in MSTS
_____we have a limited budget for books
_____it's easy enough to find the information in MSTS
_____it's the standard reference book of first resort

QUESTIONS OF GENERAL USAGE:

Now, you've just told us what you did the last time you used the text. I was wondering if you could also fill in this information for how you typically use the text. [check sheet]

24. Which chapters have you used? (Show table of contents if necessary).

25. In the last two months how many times have you used these chapters?

Chapter Name_____

Chapter Name_____

(If they mention topics, take notes on topics)

26. Now I'd like you to think about your goal in looking for information in these chapters. (Present Check Sheet) Generally, your goal could be to get a general understanding of the way a thing functions, works or looks; get specific information when you already know the general idea; figure out how isolated

things go together. Can you rate the percentage of time you have each goal? Is this consistent across chapters? (If not, do chapter by chapter, or group of chapters.)

27. We first classified your information goals as to general, specific, or interrelating. Now let's see if we can look at another way of classifying. Could you classify your use as looking for

_____a physical description or layout

_____a process

_____the function or method of functioning for a piece of equipment

(Hand him the table). Can you list the percentage of times you have each goal? Is this consistent across chapters? (If not, do it by chapter or chapter groups)

28. There is a lot of historical information in the book.

Do you ever read it? _____Yes _____No
Is it useful? _____Yes _____No
Is it necessary? _____Yes _____No

29. Now I'd like to talk about how the information is presented in the book. The information YOU eventually GET FROM THE BOOK could be in a table, graph, photo, paragraph, line drawing. What do you use each display type for most often. That is, what kind of information do you get from each of these display types?

table_____

graph_____

photos_____

paragraph_____

line drawing_____

What percent of the time does the information you actually pull out of the book come from each of these display types.? (Give him the table).

How useful have you found each of these information display types? Can you rate your satisfaction with each of these displays on a five point scale? 1 is "very good presentation of information," while 5 is "very difficult or unclear presentation."

30. If the book is revised would you like to see more or less use of each of these display types? (Point to table)

31. When you use the book how much do you usually look through in the process of finding what you need?

_____go right to a page

_____read through several pages

_____read through most of a chapter

_____read section in several different chapters

32. How difficult is it to find information relative to other books you use? (1=very difficult, 3=like any other book, 5=very easy)_____

33. In finding information in the book you use 1)your experience with the book(or chapters), 2) index, and 3) table of contents. How important is each of these ? (Rate on a scale of 1 to 5 with 1=very important, 5=not important)

_____experience with book(or chapters)

_____index

_____table of contents

34. When you go for information how adequate is the depth and breadth of coverage?

_____sufficient _____too much _____too little

35. Both the content and the organization of the book could be improved. What problems did you have with the content. If you were given the task of improving the book's content, how would you?

Problems:

Suggestions for improvement:

What problems did you have with the organization of the book. If you were given the task of improving the book's organization, how would you?

Problems:

Suggestions for improvement:

36. I was looking at the appendices to the book the other night. It has all sorts of information, periodic table of the elements, physical properties of elements, SI factors for commonly used physical units, that sort of thing. Have you ever used those appendices?

_____Yes _____No

Should the appendices be there?

_____Yes _____No _____Don't care

Do you think other parts of MSTS could be better organized into a series of tables or appendices rather than the text chapters that it has now?

_____Yes _____No

37. What would some of the tables or appendices be?

38. What are the book's major strengths?

39. What is some good alternatives to *The Making Shaping and Treating of Steel*?

40. Have you used the bibliography before to find additional materials?

_____Yes _____No

41. Was the bibliography useful?

_____Yes _____No

42. Could you rate the book on a scale of 1 to 5 (1=very good, very useful)